

Evolution of Large-Scale Plasma Structures in Comets: Kinematics and Physics -

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FINAL REPORT

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Accomplishments

The question of the physical mechanism for disconnection events (DEs) has been resolved to the extent possible with available observations and MHD simulation codes. Analysis of DEs individually (Niedner, Brandt, and Yi 1991; Yi et al. 1993; and Yi et al. 1994) and in groups (Brandt et al. 1992; Brandt, Caputo, and Yi 1992; and Yi, Caputo, and Brandt 1994) show conclusively that DEs are physically associated with crossings of the heliospheric current sheet (HCS) and with no other property of the solar wind. The data used are the extensive images of comet Halley in 1985-1986, primarily those contained in The International Halley Watch Atlas of Large-Scale Phenomena (Brandt, Niedner, and Rahe 1992). The analysis has been extended to all 19 DEs considered major in comet Halley with exactly the same conclusion (Brandt, Caputo, Hoeksema, Niedner, and Yi 1995, in preparation).

The association of DEs with HCSs indicated that theoretical work should concentrate on the appropriate solar-wind conditions. A state-of-the-art MHD simulation code was developed to probe the cometary response to changing solar-wind conditions (Yi and Brandt 1992; Yi and Brandt 1993; Yi 1994 - Thesis; and Yi, Walker, Ogino, and Brandt 1995 - in preparation). Many solar-wind changes were investigated - such as high-speed and high-density regions - but only the magnetic reversal at the HCS produces the full morphology of the DE. The topology of the magnetic field indicates that magnetic reconnection on the sunward side is the critical mechanism as proposed by Niedner and Brandt (1978).

In summary, the investigation as originally outlined is complete. Techniques have been developed for the comparison of cometary and solar-wind conditions. The MHD simulation code is a powerful tool for probing additional questions such as the energy input to the coma from magnetic reconnection during DEs, the possible changes in plasma morphology with heliocentric latitude (for comparison with observations taken in connection with the ULYSSES mission), the detailed structure of the near-nuclear magnetic field, and the time scales (and dispersion) for DEs.

Publications

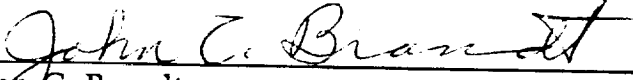
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Unclass

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 John C. Brandt
 Principal Investigator
 LASP-Campus Box 392
 University of Colorado
 Boulder, CO 80309

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